PROCESS FOR THE MANUFACTURE OF CURVED OBJECTS

The invention relates to a process for the manufacture of an object, curved in one or more directions, from a package of at least one stacked ply containing polymeric fibres by the deforming thereof at elevated temperature. The invention also relates to an object, curved in one or more directions, obtainable with the process according to the invention.

Such a process is known from the publication "The Smart Blankholder as a Development Tool for the Rubber Forming Process of Continuous Fiber Reinforced Thermoplastics" by C.A.J.R. Vermeeren et al. in the Proceedings of the ICCM held at San Diego, California, on 14-18 July 2003.

That publication addresses the problem of wrinkling in the manufacture of objects, curved in one or more directions, such as helmets, from stacked flat plies containing polymeric fibres, hereafter briefly referred to as fibre plies. As a solution it suggests clamping the border of the fibre plies in a controlled manner onto the top side of the hollow part of the die used so that material is drawn into the die in the appropriate locations and in suitable amounts as the die is closed. As the deformation mechanisms from flat plies to a curved object it mentions, besides allowing extra material to be drawn into the die in localized areas in a controlled manner, the shear or slip that occurs between and within the various plies. In addition, in the case of fibre plies such as fabrics or knittings, the elongation due to their construction obviously plays a part, too.

Controlled adjustment of the blankholder, i.e. the clamping mechanism, is a complex and time-consuming issue. Moreover, according to the article, the possible amount of the aforementioned shearing and slip is limited and wrinkling will at some point occur in the material drawn into the die anyway.

From NL 8802114A it is known to employ a blankholder having a circular recess. That publication, too, states that deformability of the fibre plies is a critical requirement and the blankholder is designed so that a greater force is exerted on the fibre plies in the directions in which deformability is greatest. Accordingly, in this process the fibre direction is preferably essentially the same in all plies. This implies that here, too, material is drawn into the die in a controlled manner and that use is made of the shear and slip occurring in the package of fibre plies.

In NL 9000079A a blankholder comparable to the one in the